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1: Plant Physiol. 1994 May;105(1):357-67.

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Identification of a light-responsive region of the nuclear gene encoding the B subunit of chloroplast glyceraldehyde 3-phosphate dehydrogenase from Arabidopsis thaliana.

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We report here the identification of a cis-acting region involved in light regulation of the nuclear gene (GapB) encoding the B subunit of chloroplast glyceraldehyde 3-phosphate dehydrogenase from Arabidopsis thaliana. Our results show that a 664-bp GapB promoter fragment is sufficient to confer light induction and organ-specific expression of the Escherichia coli beta-glucuronidase reporter gene (Gus) in transgenic tobacco (Nicotiana tabacum) plants. Deletion analysis indicates that the -261 to -173 upstream region of the GapB gene is essential for light induction. This region contains four direct repeats with the consensus sequence 5'-ATGAA(A/G)A-3' (Gap boxes). Deletion of all four repeats abolishes light induction completely. In addition, we have linked a 109-bp (-263 to -152) GapB upstream fragment containing the four direct repeats in two orientations to the -92 to +6 upstream sequence of the cauliflower mosaic virus 35S basal promoter. The resulting chimeric promoters are able to confer light induction and to enhance leaf-specific expression of the Gus reporter gene in transgenic tobacco plants. Based on these results we conclude that Gap boxes are essential for light regulation and organ-specific expression of the GapB gene in A. thaliana. Using gel mobility shift assays we have also identified a nuclear factor from tobacco that interacts with GapA and GapB DNA fragments containing these Gap boxes. Competition assays indicate that Gap boxes are the binding sites for this factor. Although this binding activity is present in nuclear extracts from leaves and roots of light-grown or dark-treated tobacco plants, the activity is less abundant in nuclear extracts prepared from leaves of dark-treated plants or from roots of greenhouse-grown plants. In addition, our data show that this binding factor is distinct from the GT-1 factor, which binds to Box II and Box III within the light-responsive element of the RbcS-3A gene of pea.

PMID: 8029358 [PubMed - indexed for MEDLINE]